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## SOME ATTRACTIONS OF THE FIELD STUDY OF ANTS

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AFTER more than thirty years devoted to the study of ants I find myself wondering why so very few of our nature lovers have engaged in this pursuit. I find that observing and collecting ants in many lands, quite apart from the benefit to my health, have yielded a keen delight which has remained with me and seems to have colored my recollections, so that I have acquired the habit, when regrets and unpleasant memories assail me, of effacing them with the memories of excursions in mountains, forests and deserts peopled by colonies of thrillingly interesting ants. Certainly the pursuit of any branch of natural history may be recommended as an avocation to our youth, to convalescents, to our tired business men or in fact to any one who craves a hobby, a surcease from the nerve-racking routine of our city life or a valid excuse for remaining as many hours as possible in the open air of the woods and fields.\* But no branch of natural history, in my opinion, is so well adapted to furthering these ends as myrmecology. I shall therefore discuss some of the advantages of ants as material for observation and study, and add

\* As the Australian myrmecologist, Mr. John Clark, remarks: "The study of ants is most interesting, and entails very little exertion. It should appeal to those whose health does not allow of vigorous work in the bush. It keeps the observer in the open, with his mind fully occupied, so that life's worries are soon forgotten, while a store of valuable information is gained. Ants are numerous everywhere. They are easily kept in artificial nests, and make interesting pets. The food required by them is always at hand, and the nests are readily made; so that no one should experience much difficulty in keeping ants for observation at home."

a brief account of the simple equipment needed by the field and laboratory observer in the hope that some of my readers may be persuaded to join the ranks of the myrmecologists. In conclusion I shall call attention to a few of the many problems to the solution of which the patient and enthusiastic student of these insects may hope to contribute.

The ants, unlike many other insect families, are represented by comparatively few species in any given locality, but, being social organisms, this deficiency is compensated by the great numbers of individuals even in very circumscribed areas. The observer, therefore, always has an abundance of material at his disposal without being confused by such a maze of species, represented by comparatively few individuals, as he would encounter in many families of flies, beetles, moths, etc. The number of species, subspecies and varieties of ants scarcely exceeds 60 in any of our New England states, and the entire ant fauna even in any one of our Southern or Southwestern states does not exceed 100 to 150. The fact that ants can be so easily collected, since their most abundant caste, the workers, are wingless and the males and females take to their wings only during the marriage flight, may also be cited as greatly facilitating their observation and study. Nevertheless, fear seems to have prevented many people from making an intimate acquaintance with these insects, though, few of our North American forms can sting or bite painfully and the great majority of them are only feebly aggressive or even decidedly timid. Probably most people are so annoyed by the sensation of ants

crawling over the skin that they fear to disturb colonies. This aversion, however, is soon overcome. There are, of course, certain stinging species like the agricultural ants (*Pogonomyrmex*) of our Western states, the driver ants (*Dorylus*) of Africa, the legionary ants (*Eciton*) of Tropical America, and the bull-dog ants (*Myrmecia*) of Australia, which make much greater demands on the fortitude of the observer. Excepting in such species, however, which equal or even surpass the honey-bee, bumblebees and wasps in aggressive and stinging behavior, the economy of ants, as compared with that of very many insects, is singularly open to observation. The structure of their nests, the whole personnel of their colonies, the peculiarities of the various castes of adult ants, all the different stages of the brood from egg to pupa, can be examined without any difficulty. The marriage flights of the males and females, the expeditions and wars and the founding and development of the nests and colonies also furnish inexhaustible material for study in the field.

Ants are so extremely sensitive to the degrees of temperature and humidity of their environment and to the character of its vegetation that many species or subspecies are confined to very narrow ecological habitats. This specificity of adaptation also furnishes interesting matter for study, especially in connection with the fact that nearly all species of ants are highly variable and exhibit many subspecies or geographical races and even more numerous varieties characterized by subtle peculiarities of color, hairiness and sculpture. Hence the great importance of the ants as material for the investigation of geographical distribution, variation and polymorphism. An even more fascinating field for observation is afforded by the intricate relations between ants and other ants and between ants and other organisms,

both animal and plant. To the former relations belong the phenomena ofinquilism, social parasitism and slavery, to the latter the relations of ants to certain peculiar plants (myrmecophytes) and myrmecophily, or the extraordinary relations of the ants to their insect guests, parasites and "cattle" (plantlice, scale-insects, certain butterfly caterpillars, etc.). Field observation thus broadens out into a study of great scope and complexity and comprises many cases of the most marvelous behavior, both on the part of the ants and of their charges, known to occur among insects.

Finally a word may be added concerning the esthetic aspect of myrmecology. Ants are not usually regarded as beautiful insects, and this is probably responsible for their neglect by many entomologists. There are, however, in the tropics some very beautifully colored forms, notably in Cuba and Australia, which possess a number of gorgeously metallic green or purple species, but those of temperate regions are apt to be merely dull yellow, reddish, brown or black. Yet even these species when viewed under a low magnification are by no means unattractive. Indeed, the form of the body, especially of the workers and males, is decidedly graceful, and the texture of the integument, with its endless variety of fine sculpturing, polish and luster and its delicate pilosity is in many species exquisitely beautiful. Unfortunately, we possess no really artistic illustrations of ants, like the famous pictures of birds, beetles, butterflies, etc., because as yet no gifted artist has interested himself in these insects.

Since field observations on the behavior of ants can be of little value without a recognition of their various species, subspecies and varieties, it is necessary to collect and preserve specimens for comparative study and as essential records of observation. This taxonomic or classificatory aspect is less irksome in

myrmecology than in the study of many other groups of insects for the reason, already mentioned, that the various forms occurring over a considerable area are not very numerous. The field worker will readily become acquainted with the majority of the forms in his state during a single season, but it may require several years for him to find all the rarer forms that nest in concealed situations. Often their colonies can be located only by carefully following accidentally encountered worker individuals till they return to the nest and thus betray its site. Even this method is impossible, however, in the case of certain minute subterranean forms, which rarely or never appear on the surface of the soil. These can be secured, as a rule only by using the Silvestri funnel described below.

The apparatus for field work in myrmecology is very simple and easily obtained. It comprises the following articles, all of which can be carried in the pockets of an outing jacket.

(1) Some cloth bags, each capable of containing about two or three quarts of earth.

(2) A large white handkerchief or a piece of white oil-cloth about a square yard in area.

(3) A number of vials of ethyl alcohol, or if this can not be readily obtained, of methylated or denatured alcohol.

(4) A pair of tweezers with fine, or preferably, with smooth, narrow, flattened points.

(5) A short, strong chisel, with a blade about an inch in diameter, a small trowel or a strong-bladed plasterer's knife.

(6) A good pocket-lens. An excellent one, with magnifications of 10 and 20 diameters is supplied by the Zeiss or Leitz optical companies.

(7) A note-book.

The uses of these articles, with the exception of (1) and (2), will be ob-

vious. An ant nest is dug up with the chisel or trowel and the earth, detritus or dead wood quickly thrown on the piece of cloth which has been spread on the ground. The material of the nest can then be carefully broken up and the ants or any other insects associated with them collected with the tweezers before they can escape. The bags are used for holding entire small or selected portions of large nests which are to be carried home or to the laboratory for more careful inspection and collection than is usually possible in the field or for installment in artificial nests.

To the articles listed above two pieces of apparatus, the "exhaustor" and Silvestri's modification of "Berlese's funnel," have been added very recently. They are so useful to the field myrmecologist that I here figure and describe them in greater detail. The exhaustor (Fig. 1) consists of a strong, wide-mouthed vial (A) furnished with a cork or rubber stopper (B) perforated for the accommodation of two tightly-fitting

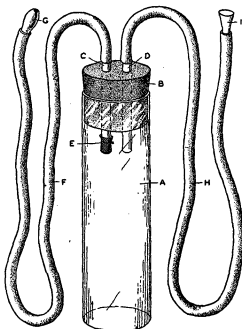


FIG. 1. THE EXHAUSTOR

glass or metal tubes (C, D). The upper end of each of these tubes is fitted into a flexible rubber tube 12 to 18 inches long, one of which (F) ends in a perforated mouthpiece (G), the other (H) in a small glass funnel (I). Neither of these attachments, however, is really necessary. The lower end of the tube C is covered with a cap of gauze (E). If this tube is made of metal instead of glass a small piece of fine wire netting soldered to the walls of its opening may be substituted for the gauze. In using the exhaustor for collecting ants and other small insects running over the ground, tree-trunks or foliage the vial is held in the left hand, the mouthpiece is placed between the lips and the opening of the funnel or the end of tube H is placed over the insect, which can then be sucked into the vial. Large numbers of extremely delicate Arthropods, such as small beetles, Pauropods, Thysanurans, springtails, mites, gnats, ants, etc., which are apt to be more or less injured if picked up with the tweezers or even with a brush dipped in alcohol, may thus be captured in perfect condition. If the collector carries a supply of vials of the same size as that of the exhaustor he can, after making a collection, remove it from the cork and substitute a fresh vial as often as desired. The captured insects can be either kept alive or killed and preserved by pouring a small amount of alcohol into the vial. The exhaustor seems to have been invented by the economic entomologists to avoid handling delicate insects with the tweezers or fingers. It should be of considerable use in physiological experimentation whenever it is necessary to move insects about without injuring their delicate wings or articulations or infecting them with foreign odors. The exhaustor is also very useful in transferring living ants from one artificial nest to another. A little practice with the instrument in the field will enable the collector to cap-

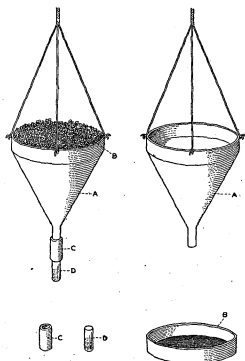


FIG. 2. SILVESTRI'S FUNNEL

ture a great number of uninjured specimens in a very short time compared with the old and laborious method of picking them up one by one with the tweezers.

The Berlese funnel is an apparatus which collects minute Arthropods automatically from samples of humus or soil. In its original form it was rather cumbersome and not easily manufactured, but Silvestri has simplified its construction without impairing its efficiency. I translate his account and reproduce his figure (Fig. 2).<sup>1</sup> "The apparatus suggested by me was described by Mr. E. Jacobson<sup>2</sup> after he had used it for several years according to my directions. It is

<sup>1</sup> F. Silvestri. Aparato para recolección de pequeños Artrópodos. Conf. y Res. Real Soc. Española de Hist. Nat. Madrid, p. 10-13, 1 fig., 1930.

<sup>2</sup> E. Jacobson. Hilfsmittel beim Fang und Präparieren von Insekten, besonders in den Tropen. Deutsch. Ent. Nation. Bibliothek 1, pp. 94-95, fig. 8, 1910.

very simple, consisting of a funnel (A), which can be suspended by three cords wherever desired; of a sieve (B), with meshes one to two millimeters in diameter, and a glass vial (D) containing alcohol and attachable to the end of the funnel by means of a piece of rubber tubing (C). This apparatus, thus simplified, is very convenient, especially for traveling naturalists, because they can have two or more funnels made, of slightly different diameters, so that they can be fitted one inside the other and thus occupy but little space. In my travels I have always had with me since 1908 three of these funnels, which have never caused me any inconvenience. . . . This apparatus may be made of sheet zinc or, more economically though less durably, of tin. It requires no attention after the selected material [humus, detritus, soil, etc.] has been placed in the sieve, [this set in the top of the funnel], and the vial of alcohol attached to the end of the funnel. The length of time the material should be left in the sieve is very variable, depending on the quantity and humidity of the material and the temperature and humidity of the surrounding air." With the gradual drying out of the contents of the sieve, the minute insects fall one by one into the funnel and thence into the vial of alcohol at its lower end. "This simple apparatus," as Silvestri states; "should be used by all entomologists interested in the microgenton and especially by those who have an opportunity to live for some time in tropical regions where it is still possible to discover many interesting Arthropods." He coined the term "microgenton" to embrace all the minute, poorly pigmented and usually blind Arthropods that inhabit vegetable mold, soil, dead leaves, decayed wood, etc. Quite a number of our smallest ants belong to this remarkable ecological association and are very difficult to collect without the aid of the funnel above described.

Perhaps in this connection another and very different piece of labor-saving collecting apparatus should be mentioned, namely, the automobile. Its value to the field myrmecologist especially, in enabling him to visit remote and unfrequented territory without fatigue and loss of time, can not be exaggerated. It will probably be found that both private and museum collections have greatly increased the number and variety of their accessions, especially of insects and other invertebrates, since the automobile came into general use.

The myrmecologist will be led naturally to supplement his field observations with observations in the laboratory. Though this may be as unpretentious as any small well-lighted room in a house, he will wish to equip it with the apparatus both of the entomologist—insect boxes, insect-pins, labels, etc., and those of the histologist—compound microscope, binocular dissecting microscope and the usual glassware and reagents. He will also need a number of artificial nests for living colonies of ants. I have described some of the various patterns of these in an appendix to my ant book,<sup>3</sup> and a few others in a note published in 1910.<sup>4</sup> During recent years I have found that colonies of small ants can be kept for some time in ordinary Petri dishes, pro-

<sup>3</sup> W. M. Wheeler. "Ants, Their Structure, Development and Behavior," Columbia Univ. Press, N. Y. 1910; reimpr., 1926.

<sup>4</sup> W. M. Wheeler. "Small Artificial Ant-nests of Novel Patterns," *Psyche*, April, 1910, pp. 73-75, 1 fig. There is an excellent chapter on artificial nests and on collecting, and preserving ants in H. Donisthorpe's "British Ants," 2nd ed., 1917. The following recent literature on ant-study and artificial nests may also be consulted with profit: H. Kutter, "Züchtung von Ameisen," in E. Abderhalden's "Handbuch der biologischen Arbeitsmethoden," 1926; A. Stärcke, "Ein neues Formicarium," *Zool. Anzeig.*, 92, 1930, pp. 152-155; H. Eidmann, *Zeitschr. f. vergleich. Physiol.*, 3, 1926, pp. 776-821, and 7, 1928, pp. 39-55; E. Meyer, *Biol. Zentralbl.*, 43, 1923, pp. 353-404 and 47, 1927, pp. 264-307.

vided the optimum supply of humidity and food is maintained. The colonies can be readily transferred when required from fouled to clean dishes, by means of the exhaustor.

The beginner in myrmecology may become disconcerted or even depressed when he discovers what an enormous mass of literature on the ants has been produced during the past two centuries. The veteran investigator may, perhaps, encourage him with the statement that we are only just entering on the more experimental and statistical and therefore more serious, interesting and enlightening study of these extraordinary insects. It is generally agreed that ants communicate with one another, but the precise character and scope of this behavior in the various species have never been satisfactorily ascertained. The same is true of the homing behavior, though it has been the subject of much valuable experimental investigation. We are still very much in the dark in regard to the feeding of the larvae by the workers and therefore of the precise method of determining the development of the various castes (polymorphism), which are such a striking feature of the ant

community. Our knowledge of the parasitic and slave-making ants and of the interrelations of ants and myrmecophiles remains very sketchy. We possess no satisfactory information concerning the factors that initiate and control the movement of ant colonies to new nesting sites. The population of an adult ant-colony seems to be a true specific character, but we have almost no statistical data on the number of ants in fully developed colonies in various species, on the rate of the development of colonies or on their life-span. Moreover, certain investigations which have been carefully pursued in Europe have never been extended to our American ant fauna, such as those relating to the interesting transportation and distribution of plant seeds (myrmecochory). This list of matters awaiting further elucidation might be indefinitely increased. For the solution of those mentioned the ant-fauna of the United States, which is so much richer than that of Europe, should afford adequate material, without resort to the splendid but less easily accessible neotropical fauna of the West Indies, Mexico and Central America. We only need more myrmecologists.